

The typification, defining features and geographical range of *Calymperes cougiense* Besch. (Calymperaceae, Musci)

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SYNOPSIS. A neotype is proposed for *Calymperes cougiense* Besch. and the features are outlined by which the species may be distinguished from *C. subintegrum* Broth. and *C. porrectum* Mitt. Owing to its confusion with these latter species, most reports of its occurrence in Malesia are erroneous. The distribution of *C. cougiense* includes NE Australia and the islands of the Pacific as far east as the Tuamotu Archipelago.

Research for this paper was inspired by the discovery that, contrary to citations in the literature, the holotype of *Calymperes cougiense* Besch. is not in Bescherelle's herbarium (BM). An examination of many specimens identified as *C. cougiense* revealed a long-standing confusion of this species with some forms of *Calymperes porrectum* Mitt. and *Calymperes subintegrum* Broth. These problems of typification and identification are addressed below.

Calymperes cougiense Besch. in *Ann. Sci. Nat. Bot. sér. 5*, 18: 206 (1873). Type: New Caledonia, Balade, Vieillard 1776 (BM!-neotype, designated here; S!-isotype?).

Calymperes setosum Müll. Hal. in *J. Mus. Godeffroy* 3(6): 64 (1874). Type: Samoa, Upolu, Graeffe s.n. (BM!, S!-isotypes).

Calymperes marginatum Dixon in *Proc. Linn. Soc. New South Wales* 55: 275 (1930). Type: Fiji, Vanua Levu, 3000 ft, December 1922, Greenwood 474 (BM!-holotype).

Calymperes pseudopodianum E.B. Bartram in *Occas. Pap. Bernice Pauahi Bishop Mus.* 10(10): 7 (1933). Type: Pacific Islands, Tuamotu Archipelago, Makatea, 3 March 1930, Emory s.n. (FH-holotype).

Typification

There has been some misapprehension with regard to the typification of *Calymperes cougiense* Besch. In the protologue, Bescherelle (1873) cited a type specimen from New Caledonia – ‘Ad cortices in monte Cougui (BALANSA)’. Reese & Mohamed (1985) and Reese & Stone (1995) cited this specimen as being housed in BM. However, the holotype of *Calymperes cougiense* (Balansa s.n.) is not in Bescherelle's herbarium (BM) and isotypes have not been found in BM or in other likely herbaria elsewhere (FH, H, L, MEL, MO, NY, PC, S). Hitherto, a non-type collection in BM, identified as *C. cougiense* by Bescherelle (1895), appears to have been mistaken for the type specimen. Although annotated as type material by recent authorities, it is clearly labelled ‘Nov. Caled. Balade Vieillard No. 1776’. In Möller's herbarium (S) there is an apparent duplicate of Vieillard 1776 which has also been mistaken for type material. The outer packet of this specimen is marked ‘Vieillard 1776’ and stamped ‘TYPUS’. Confusingly, the inner packet bears a label with the collection details of Vieillard 1776 followed immediately by those of Balansa s.n. This is possibly a rendition of the specimen citation published by Bescherelle (1895) rather than a specific reference to the contents of the packet. The true origin of this specimen remains uncertain.

In the absence of material clearly identifiable as Balansa's collec-

tion, *Calymperes cougiense* requires neotypification. The authentic material, Vieillard 1776 in Bescherelle's herbarium (BM), is here proposed as the neotype.

Taxonomy

Calymperes subintegrum Broth., *C. porrectum* Mitt. and *C. cougiense* Besch. all possess similar strongly dimorphic leaves (i.e. erect, linear gemmiferous leaves, largely consisting of thick costae (Fig. 1b) which project above a canopy of vegetative leaves with narrower costae and relatively broad laminal blades (Fig. 1a)).

Collections of *Calymperes subintegrum* and of diminutive forms of *Calymperes porrectum* have often been misidentified as *C. cougiense*. This has led to a misrepresentation of the latter species both in herbaria and in recent literature. For example, the illustrations of *C. cougiense* by Eddy (1990) mostly depict leaf features of *C. porrectum*, and Reese, Koponen & Norris (1986) cited only misidentified material in their account of the species.

The distinguishing features of *Calymperes cougiense*, *C. porrectum* and *C. subintegrum* are outlined in a key and discussed in detail below.

Key features of *Calymperes porrectum* Mitt., *C. subintegrum* Broth. and *C. cougiense* Besch.

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|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| 1 | Non-gemmiferous leaves recurved, costa smooth, cells of chlorophyllose lamina smooth and flat; leaf margin with intramarginal polystratose rib, serrate (Fig. 1r, t) | Calymperes porrectum |
| | Non-gemmiferous leaves erect to spreading, costa scabrid to some degree, cells of chlorophyllose lamina projecting from the ventral and/or dorsal surfaces of the leaf; leaf margin with or without rib, subtentire to denticulate | 2 |
| 2 | Cells of chlorophyllose lamina 7.5–15(–>20) × 5–10(–12.5) µm, dorsally flat (occasionally unipapillose) (Fig. 1m, o) | Calymperes subintegrum |
| | Cells of chlorophyllose lamina <5–10(–12.5) × 5–7.5(–10) µm, dorsally unipapillose (invariably) (Fig. 1d, i) | Calymperes cougiense |

For an illustrated account of *Calymperes porrectum* Mitt. with synonymy see Eddy (1990), and see Ellis (1991) for a similar treatment of *Calymperes subintegrum* Broth. Recent useful accounts of *Calymperes cougiense* Besch. include those by Reese & Mohamed (1985), Reese, Koponen & Norris (1986) and Reese & Stone (1995).

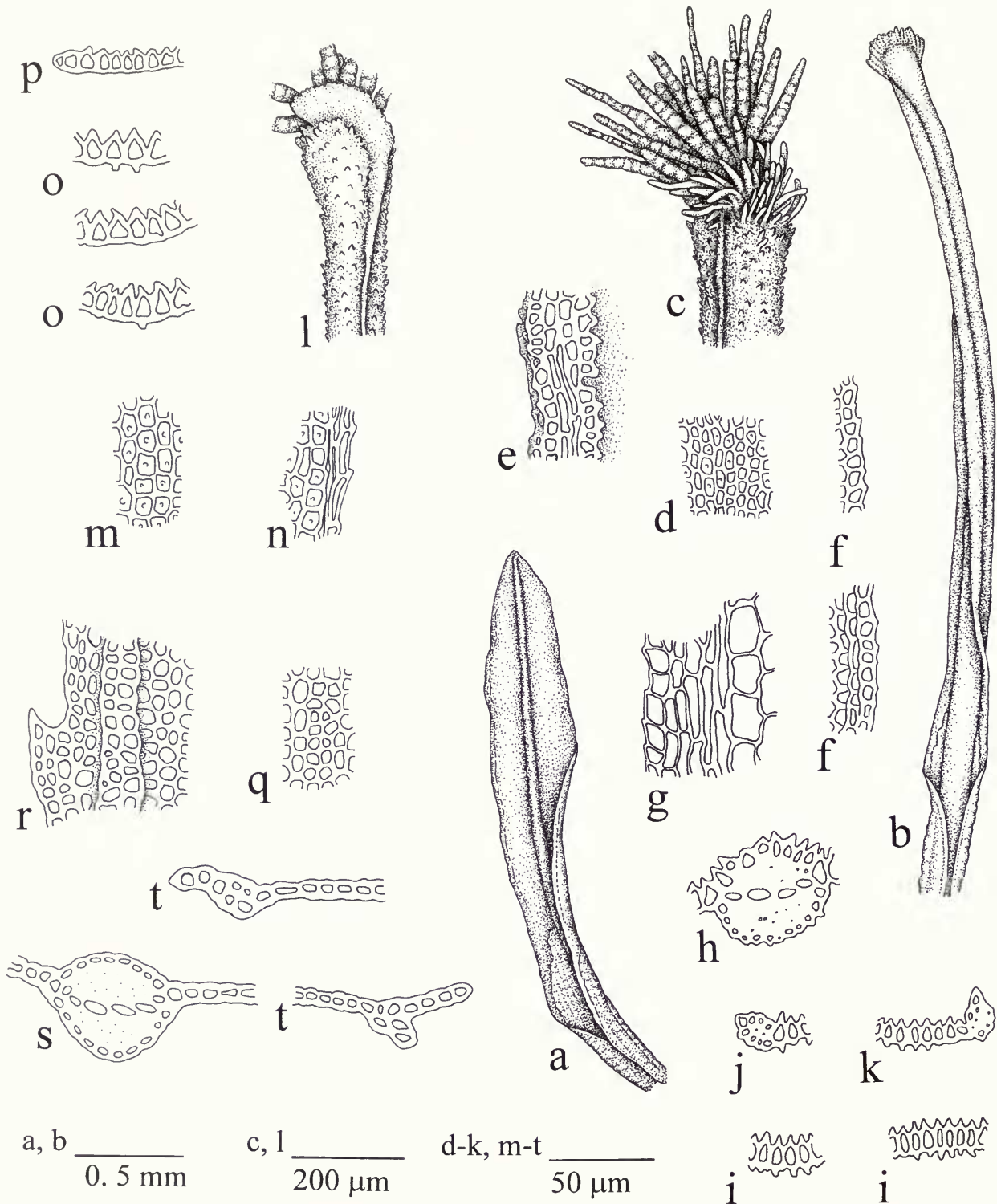


Fig. 1 a-k. *Calymperes couguiense* Besch. a-c. leaves (a: non-gemmiferous leaf, b: gemmiferous leaf (gemmae missing), c: apex of gemmiferous leaf in lateral view); d-g. cells of leaf in surface view (d: chlorophyllose lamina (ventral view), e, f: margin of chlorophyllose limb (ventral view), g: margin at mid hyaline base), h-k. cross-sections of chlorophyllose limb (h: costa, i: lamina, j, k: margin). l-p. *Calymperes subintegrum* Broth. l. apex of gemmiferous leaf in lateral view, m, n. cells of chlorophyllose limb in surface view (m: lamina, n: margin), o, p. cross-sections of chlorophyllose limb (o: lamina, p: margin). q-t. *Calymperes porrectum* Mitt. q, r. chlorophyllose limb in surface view (q: lamina, r: margin), s, t. cross-sections of chlorophyllose limb (s: costa, t: lamina and margin). a, c. Drawn from Society Islands, *De Sloover* 20962 (H). b, e, g-j. Drawn from New Caledonia, *Veillard* 1776 (BM). d. Drawn from Australia, *Stone* 18577 (MEL). f, k. Drawn from Samoa, *Graeffe* s.n. (BM). l, m, o. Drawn from Australia, *Stone* 23095 (MEL). n, p. Drawn from New Guinea, *Zanten* 149c (BM). q-t. Drawn from New Ireland, *Eddy* 6333 (BM).

DISCUSSION. Shoots of *Calymperes porrectum* possess strongly recurved non-gemmiferous leaves with a smooth costa (Fig. 1s) and chlorophyllose lamina (Fig. 1t). The laminal chlorocysts form a largely flat surface, but are sometimes very slightly protuberant ventrally. In surface view they reach $<5-10(-12.5) \times <5-10(-12.5) \mu\text{m}$, smaller on average, and more irregularly polygonal or rounded, than those in *C. subintegrum* (see below). A differentiated rib lies well within the margin of the leaf, and extends from the leaf base to near the apex. Above the hyaline lamina it becomes polystratose and projects slightly from the dorsal leaf surface (Fig. 1t). Adjacent to this rib, a narrow, unistratose marginal lamina, (2-)3-5(->6) cells wide, is formed, which at intervals gives rise to subtriangular, often multicellular, teeth (Fig. 1r). In gemmiferous leaves the costa is scabrid and slightly excurrent; gemmae are produced in a cluster from the costal apex. Adjacent to the cluster of gemmae some superficial costal cells become elongated and finger-shaped.

In *Calymperes subintegrum* the non-gemmiferous leaves are erect to spreading and possess more or less scabrid costae. The cells of the chlorophyllose lamina are flat dorsally (occasionally unipapillose), but project acutely from the ventral surface of the leaf (Fig. 1o). In surface view they reach $7.5-15(->20) \times 5-10(-12.5) \mu\text{m}$, and are mostly subrectangular (Fig. 1m). A narrow, intramarginal, unistratose (rarely bistratose) rib of linear cells is usually apparent. Adjacent to this, a single row of subrectangular cells (ventrally and dorsally flat) forms a subentire to denticulate margin (Fig. 1n, p). Unlike in *C. porrectum* and *C. couguiense*, the costa in the gemmiferous leaves of *C. subintegrum* ceases just below the leaf apex. This is formed by a narrow band of lamina, and gemmae are produced only from the ventral surface of the costal tip (Fig. 1l). Adjacent to the clustered gemmae a few elongated, finger-like cells may protrude from the surface of the costa. Unfortunately, the disposition of gemmae and lamina is often obscured by damage, or in well-developed leaves, by the backward flexing of the leaf tip. In practical terms, this slightly limits the value of the apices of gemmiferous leaves as a reliable distinguishing feature.

In *Calymperes couguiense* the non-gemmiferous leaves have a similar disposition to those in *C. subintegrum* and are never notably recurved. They have scabrid costae (Fig. 1h), and the cells of the chlorophyllose lamina are ventrally acutely protuberant and dorsally unipapillose (Fig. 1i). Superficially they are visibly smaller than those of *C. porrectum* and *C. subintegrum*, reaching $<5-10(-12.5) \times 5-7.5(-10) \mu\text{m}$ (Fig. 1d). Above the hyaline lamina, the leaf margins are often formed by a subentire to denticulate, polystratose rib (Fig. 1e, j, k). This sometimes appears to be intramarginal, particularly when seen in surface view. In the leaves of many specimens the marginal/intramarginal rib is poorly developed to absent (Fig. 1f). The gemmiferous leaves possess apices similar to those of *C. porrectum*, with an excurrent, scabrid costa and gemmae produced in a cluster from the costal tip. The lamina narrows into the costal apex, its distal-most cells, and the distal-most superficial cells of the costa are elongated, finger-like with rounded ends; they form a regular to irregular fringe at the base of the crown-like cluster of gemmae (Fig. 1c). These sterile, projecting cells are a consistently well-developed feature in collections of *C. couguiense*.

HABITAT. *Calymperes couguiense* Besch. evidently flourishes in habitats ranging from undisturbed forest to cultivated gardens, and has mostly been collected from sea level to below 500 m. Both *Calymperes porrectum* and *Calymperes subintegrum* occur within this altitudinal range, but records of these species extend to over 1000 m. *Calymperes couguiense* also shares some substrate

preferences with *C. porrectum* and *C. subintegrum*, occurring on tree boles, twigs and dead wood. Well-developed turfs of *C. couguiense* have also been collected on sandy soil.

DISTRIBUTION. *Calymperes couguiense* Besch. is largely a species of the Pacific islands and northeastern Australia. Reports of its occurrence in Java and New Guinea (Reese, Koponen & Norris, 1986; Reese & Stone, 1987, 1995) appear to be unsupported by specimens. Misidentified collections from the Malay Peninsula (*Spare* 3213b, BM), Java (*Fleischer* 70, BM, FH, NY; *Schiffner* 3, BM) New Ireland (*Eddy* 6165, BM), and New Guinea (*Zanten* 190a, NY) represent a diminutive form of *Calymperes porrectum* Mitt. A further wrongly determined collection from New Guinea (*Zanten* 149c, BM) is *Calymperes subintegrum* Broth. Of the material seen for this present study, only a single collection from New Britain (*Streimann* 40215, NY) indicates the presence of *Calymperes couguiense* in Malaysia.

Orbán (1995) identified specimens from the Seychelles as *C. couguiense* and Reese & Stone (1987) cited Mauritius as a station. Unfortunately, the material on which the latter citation is presumably based (*Balfour* s.n., NY) represents a form of *Calymperes hispidum* Renaud & Cardot.

SPECIMENS EXAMINED. *Calymperes couguiense* Besch. **Australia.** Queensland: Cook, Cairns, Crystal Cascades, 16° 55' S 145° 46' E, July 1979, *Stone* 15334 pro parte (MEL), 15349 pro parte (MEL); Cook, Bellenden Ker National Park, Goldsborough Track, The Boulders, 6 km W. of Babinda, 17 July 1987, *Stone & Reese* 24451 (MEL); Cook, rainforest in saddle between Bartle Frere and Bellenden Ker ranges, 8 km W. of Babinda, 7 July 1987, *Reese, Stone & Stone* 17038 (NY); Cook, Mt Bellenden Ker, 17° 16' S 145° 51' E, 4 September 1986, *Stone* 24121 (MEL), 24122 (MEL), 24123 (MEL); Cook, Mossman Gorge, 16° 28' S 145° 21' E, 1 September 1986, *Stone* 24061 (MEL), 24045 (MEL); Cook, Mossman Gorge, May 1975, *Stone* 8837 pro parte (MEL), 12037 pro parte (MEL); Cook, Mossman, Rex Creek, 16° 28' S 145° 16' E, 30 June 1982, *Stone* 19642 pro parte (MEL); Cook, Wooroonooran National Park, Josephine Falls, 17° 25' 58" S 145° 51' 32" E, 19 August 1986, *Stone* 23904 (MEL); Cook, Cardstone, Tully, 17° 55' S 145° 55' E, 20 May 1985, *Stone* 23113 (MEL); North Kennedy, Kennedy Bay, 17° 58' S 146° 04' E, 16 May 1982, *Stone* 18573 pro parte (MEL), 18577 (MEL); 9 July 1982, *Stone* 19987 (MEL), 20000 (MEL); North Kennedy, Cardwell, Conn Creek, 18° 15' S 145° 43' E, 8 August 1980, *Stone* 16337 (MEL); North Kennedy, Cardwell, Stoney Creek, 18° 35' S 145° 48' E, 21 July 1979, *Travers* 14876 pro parte (MEL), 20 May 1982, *Stone* 18666 pro parte (MEL); North Kennedy, Tully, Kooroomool Creek, 17° 52' S 145° 42' E, 25 May 1982, *Stone* 18803 pro parte (MEL). **New Britain.** Hoskins, town area, 5° 26' S 150° 25' E, 16 February 1989, *Streimann* 40215 (NY). **Mariana Islands.** Guam, limestone forest 6 miles N. of Agana, 13 November 1945, *Holland* 21 (FH). **New Caledonia.** Balade, *Vieillard* 1776 (BM, S). **Fiji.** Viti Levu, Suva, 25 January 1923, *Greenwood* 477 (FH); Vanua Levu, December 1922, *Greenwood* 474 (BM). **Samoa.** Tutuila, Vatia, *Bryan Jr* s.n. (FH); Tau, 4 October 1939, *Yuncker* 9243 (FH!); Tau, Judd's Crater, NW rim, 27 July 1938, *Harris* 413 (FH), 414 (FH); Upolu, Mataulu village, Lefaga Bay, 24 October 1953, *Irwin* 122 (FH). **Tuamotu Archipelago.** Makatea, 3 March 1930, *Emory* s.n. (FH). **Society Islands.** Tahiti: Gaugin Museum, 26 May 1988, *Hegewald & Hegewald* 11477 (MO); Insel Huahine, *Hegewald & Hegewald* 11442 (MO); Mooréa, au-dessus du point de vue du Belvédère, 11 July 1975, *De Sloover* 20962 (H, NY).

SPECIMENS MISIDENTIFIED AS CALYMPERES COUGUIENSE BESCH. *Calymperes boulayi* Besch. – **Australia.** Queensland: along 'Sullivan's Track', c. 6 km WNW of Cardwell, 22 July 1987, *Reese, Stone & Stone* 17168 (MO).

Calymperes hispidum Renaud & Cardot – **Mauritius.** *Balfour* s.n. (NY).

Calymperes moluccense Schwägr. **New Caledonia.** Ilot au Sud de l'île, May 1988, *Martin* s.n. (PC).

Calymperes porrectum Mitt. – **Malay Peninsula.** Perak, Kampong Ijok,

25 August 1940, *Spare* 3213b (BM!). **Java**. Buitenzorg, Botanic Garden, March 1899, *Fleischer* 70 (BM, FH, NY), March 1894, *Schiffner* 3 (BM). **New Ireland**. East coast, Danfu Valley, 2 February 1970, *Eddy* 6165 pro parte (BM!). **Papua New Guinea**. Kau River, below Star Mountains, Woropko, Zanten 190a (NY).

Calymperes strictifolium (Mitt.) G. Roth (forma) (*C. francii?*) – **New Caledonia**. Rivière Bleu Reserve, near bridge over Rivière Bleu, 7 September 1981, *Crosby* 14325 (NY).

Calymperes subintegrum Broth. – **Australia**. Queensland, Cook, Wooroonooran National Park, Josephine Falls, 17° 25' 58" S 145° 51' 32" E, 19 August 1986, *Stone* 23905 pro parte (MEL). **Fiji**. Viti Levu, hills between Navua and Suva, May 1943, *Greenwood* 903 (BM), 976 (BM). **Papua New Guinea**. Ajerok, 24 May 1959, *Zanten* 149c (BM).

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